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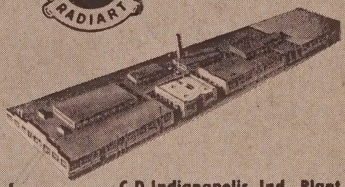

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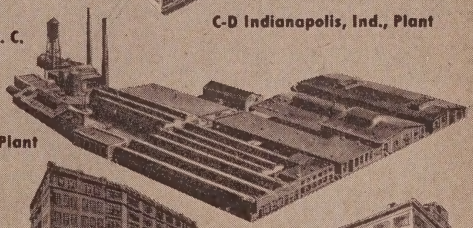

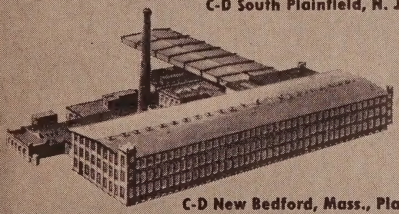

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Vol. 16 NOVEMBER, 1951 No. 11

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PRACTICAL R-C CIRCUITS

RESISTANCE and *CAPACITANCE* may be combined in a number of ways to obtain interesting and useful special-purpose circuits. R-C circuits are comparatively simple, usually are small in size and light in weight, are relatively unsusceptible to the effects of magnetic fields, and lend themselves readily to variation of one or more circuit elements for adjustment of response characteristics.

R-C circuits are commonly employed to shift phase, accentuate a band of frequencies, suppress a band of frequencies, introduce time delay, change the waveform of an applied voltage, or to perform some desired combination of these functions. These circuits are found in electronic equipment, as well as in radio and television sets.

The experimenter will find a valuable tool in a working knowledge of basic R-C circuits. He may obtain a number of desired operations within an electric circuit, either with or without tubes, through use of these resistor-capacitor combinations. This artical describes the basic R-C circuits and explains some of their principal applications. Other uses will occur readily to the student of radio-electronics.

Simple Series and Parallel Circuits

The simplest possible R-C circuits are those which contain only one capacitor and one resistor. Obviously, there are only two combinations possible with single elements. They are (1) resistance and capacitance in series, and (2) resistance and capacitance in parallel.

Figure 1 shows the simple series-connected resistance-capacitance circuit and lists the principal formulae which express rudimentary mathematical relationships in this circuit. An alternating current flowing through the *series* R-C combination encounters an impedance comprised of the capacitive reactance and pure resistance in series. The magnitude of this impedance, Z, is expressed by the first equation. Impedance Z, capacitive reactance X_c, and resistance R all are expressed in ohms. In determining the reactance of the

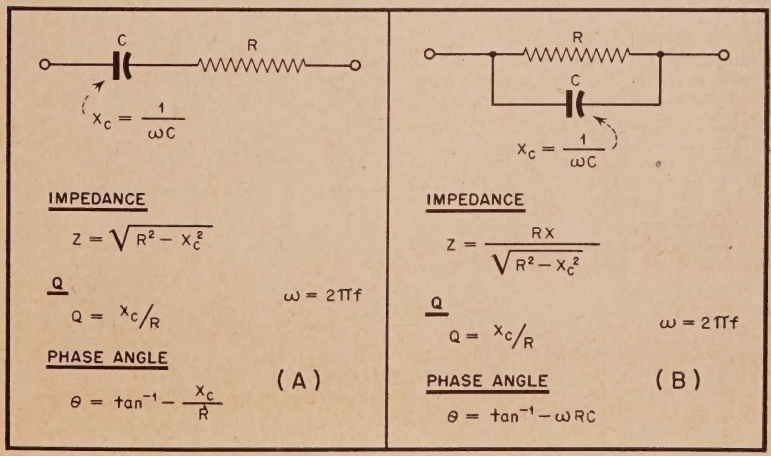

Fig. 1. (A) Resistance and capacitance in series. (B) Resistance and capacitance in parallel.

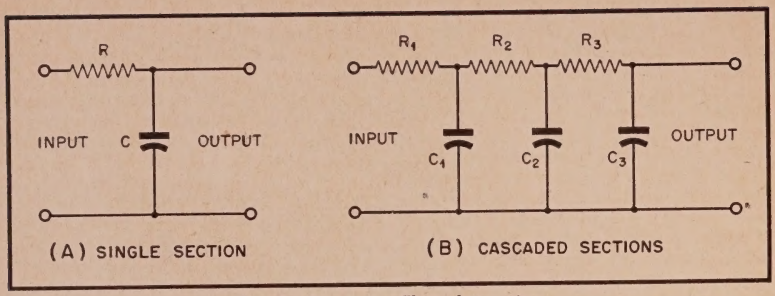

Fig. 2. Low-pass filter, integrator.

capacitor, frequency f in the denominator of the reactance formula is expressed in cycles per second, and capacitance C in farads. The second equation expresses the Figure of Merit or Q of the circuit. This is the ratio of reactance (in ohms) to resistance (in ohms). The phase angle is given by the third equation. This latter equation is read "the angle whose tangent is equal to X/R." Both X and R are expressed in ohms.

Figure 2 gives similar data for the *parallel* combination of resistance and capacitance. Note in this case that the impedance equation (number one) and the phase angle equation (number three) differ from corresponding equations in Figure 1.

The series circuit (Figure 1) is found in coupling systems, regenerative and degenerative feedback networks, tone controls, timers, and attenuators, to mention a few of the outstanding applications. The parallel circuit (Figure 2) is encountered in grid-leak detector input circuits, self-biased tube cathode circuits, bypassed bleeders for power supplies, R-C filters, and timing circuits.

Special Applications of the Series Circuit

Figures 2 and 3 show special adaptations of the series R-C circuit. In Figure 2A, alternating current is applied to the input terminals. This current produces a voltage drop E_r across the resistor, and another E_x across the capacitor. The output voltage is taken from across the capacitor and accordingly is equal to E_x. Assuming pure reactance in the capacitor and pure resistance in the resistor, the two voltage drops will be equal when the capacitive reactance is equal to the resistance. In Figure 3A, the two circuit components have been interchanged in position. In this instance, alternating current flowing as a re-

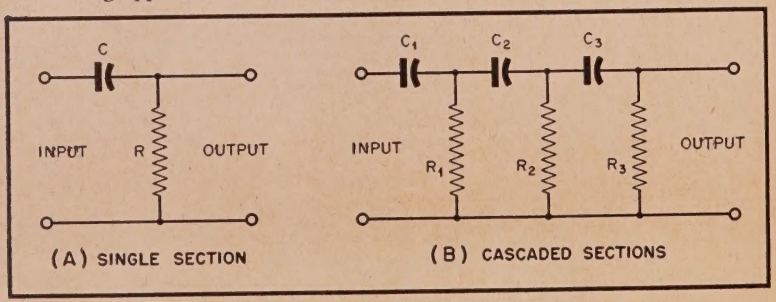

Fig. 3. High-pass filter, differentiator.

sult of application of the input voltage produces voltage drops E_x and E_r across the capacitor and resistor, respectively. Here, however, unlike the case of Figure 2A, output voltage is taken from across the resistor and therefore is equal to the component E_r.

The circuit of Figure 2A passes low frequencies more readily than high frequencies. High frequencies tend to be bypassed by the capacitor. Frequency discrimination is governed by the ratio of C to R. This circuit consequently is a resistance-capacitance type of low-pass filter. Because the Q of the R-C circuit is lower than that of a comparable inductive-capacitive filter section, the R-C circuit does not have the sharp cutoff point of the L-C circuit. Its response may be sharpened, however, by cascading several such R-C sections, as shown in Figure 2B. The number of sections which can be cascaded in this manner depends upon how much signal voltage attenuation can be tolerated in a particular application, since each succeeding section tends to reduce the signal further. In spite of its inherent lack of sharpness, the simple R-C filter has found wide application in circuits where its insertion loss is not as important as the compactness, simplicity, and freedom from hum pickup which this type of circuit offers.

The R-input C-output filter of Figure 2 also is the *integrator* circuit employed in television receiver circuits to separate the low-frequency vertical synchronizing pulses from the horizontal pulses.

The circuit of Figure 3A passes high frequencies more readily than low frequencies. This characteristic results from ability of the capacitor to transmit high frequencies. Frequency discrimination of the circuit depends upon the time constant of the R-C combination. This circuit is in contradistinction to those in Figure 2, and is a high-pass filter. In this case, as in the low-pass filter of Figure 2, the relatively low Q of the R-C circuit prevents the latter from attaining the sharp cutoff which would be characteristic of a comparable L-C circuit. However, the frequency response may be sharpened to some degree by connecting several such R-C sections in cascade, as shown in Figure 3B, the number of such sections which can be used being governed by the amount of signal voltage attenuation which can be tolerated.

The C-input R-output filter of Figure 3 also is the *differentiator* circuit employed in television receivers to separate the high-frequency horizontal synchronizing pulses from the composite sync signal and to transmit them ahead in the circuit.

By cascading one or more high-pass sections (Figure 3) with one or more low-pass sections (Figure 2), a band-pass filter may be obtained. The response of a filter of this type is rather broad, however, due to the relatively

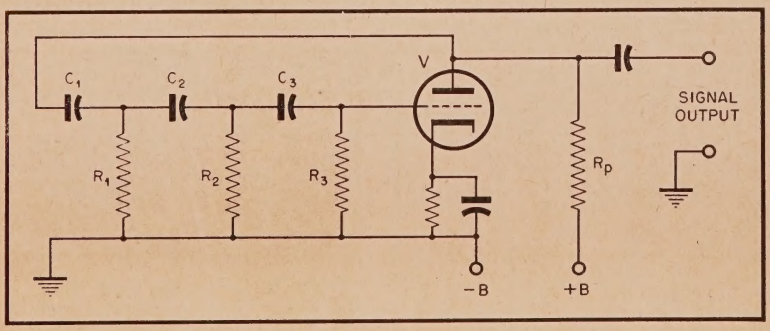

Fig. 4. Phase shift oscillator.

low Q of the R-C sections, and this feature limits the scope of application of the circuit.

The frequency response characteristic of the R-C filter may be adjusted by varying either the resistance or capacitance arm. It usually is more convenient, however, to vary the resistance, since continuously variable capacitors are not obtainable in the large capacitance values required in most practical R-C circuits. In cascaded R-C filters, the corresponding resistance in each section must be varied simultaneously, a requirement calling for close tracking of a ganged multisection rheostat. Such fine tracking is not available except in expensive variable resistors.

Figure 4 shows a special application of the high-pass filter described in Figure 3. In this *phase shift oscillator* circuit, signal voltage is fed back from the plate circuit of tube V through the filter network (comprised of C_1 C_2, C_3, R_1, R_2, and R_3) to the tube grid. Oscillation then occurs at the single frequency determined by the characteristics of the network.

Inasmuch as a 180-degree phase shift is required to insure oscillation, a 60-degree shift must be introduced by each R-C section. This is the reason why three is the minimum number of sections which may be employed in an oscillator of this type. Two sections may not be employed, since it is not easy in practice to obtain the 90 degrees of shift which would be required in each of the two sections.

The phase shift may be calculated by means of the third equation in Figure 1. Network resistor R_1 must be large with respect to plate resistor R_p, in order that the feedback voltage will not be attenuated drastically by the first section of the feedback network. For the same reason, R_2 should be larger than R_1, and R_3 larger than R_2. In addition to its main function in the feedback network, capacitor C_1 serves to isolate resistor R_1 from the d. c. plate voltage of the tube.

The phase shift oscillator undoubtedly is the simplest and most compact resistance-capacitance type of oscillator having good output waveform and output amplitude. It may be built around either a triode or pentode tube. This circuit usually is a single-frequency arrangement, however, since some difficulty is experienced in obtaining satisfactory tracking between three large variable capacitors or three commercial grade variable resistors in a continuously variable oscillator. In a variable-frequency circuit, all three capacitors or all three resistors would have to be varied simultaneously. Phase shift oscillators in which the frequency is varied in steps by switching into the circuit various fixed resistance or capacitance values have been entirely satisfactory.

The circuit shown in Figure 5 utilizes the phase characteristics of the simple series-type R-C circuit to give a compact, continuously variable phase shifter. This arrangement is a 4-arm bridge in which the arms are resistors R_1, R_2, and R_3, and capacitor C. Adjustment of the variable arm, R_3, varies the phase of the output signal voltage with respect to that of the input signal voltage.

To understand operation of the circuit, note must be taken of the fact that two legs of the circuit are connected in parallel across the input voltage source. One of these legs contains R_1 in series with R_2. The other leg is composed of capacitor C in series with R_3. When an alternating voltage is applied to the two input

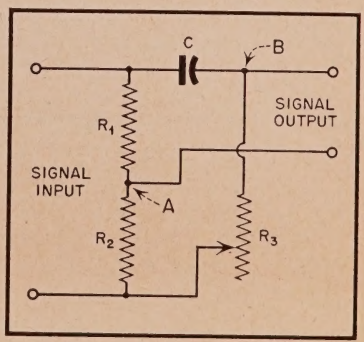

Fig. 5. R-C phase shifter.

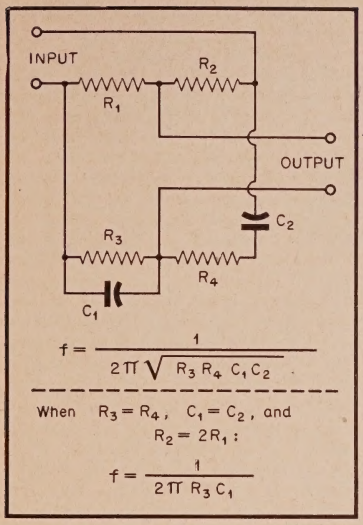

Fig. 6. Wien bridge. (Null circuit and band suppression filter)

terminals, an alternating current flows through the circuit dividing between the two legs. Current through the resistive leg (R_1R_2) is in phase with the applied voltage, since this leg contains resistance only. Current through the CR_3 leg leads the applied voltage because capacitor C introduces a leading phase shift. The voltage at point B, which is the junction point between C and R_3, accordingly reaches its peak value ahead of the voltage at point A which is the junction point between R_1 and R_2. If the output voltage is taken from A and B, its phase will lead the phase of the input voltage by an angle between zero and 90°, the value of this angle depending upon the setting of R_3. Low angles are obtained when R_3 is large with respect to C, and high angles when R_3 is small.

Since the output voltage terminals (A and B) are taps along the parallel legs of the circuit, resulting voltage divider action reduces the amplitude of voltage appearing at the output terminals. For this reason, the output voltage always will be some value less than the input voltage. This signal attenuation which accompanies the phase shift must be taken into consideration when the phase shifter is incorporated into other circuits.

Frequency Selective Networks

Figures 6, 7, and 8 show frequency-selective R-C null circuits. At some input-voltage frequency determined by the R and C values in these circuits, transmission becomes zero (or some low minimum). The circuit thus is set to null at one frequency (or a narrow band of frequencies). By adjustment of one or more of the resistance or capacitance elements, null may be obtained at other frequencies. These circuits are the basis of resistance and capacitance measuring devices, audio frequency meters, distortion meters, selective networks for amplifiers or oscillators, and R-C-type frequency rejection or band suppression filters.

The first circuit, Figure 6, is that of the Wien bridge. This bridge arrangement is unique in the respect that one of its arms (C_1R_3) contains resistance and capacitance in parallel, while another arm (C_2R_4) contains resistance and capacitance in series.

The first equation in Figure 6 shows

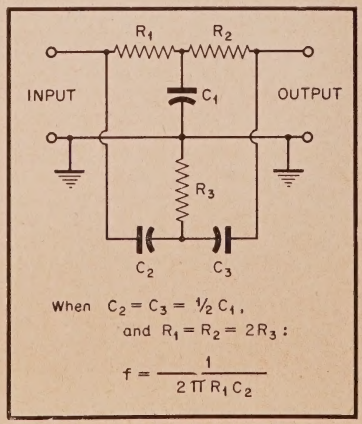

Fig. 7. Parallel-T network. (Null circuit and band suppression filter)

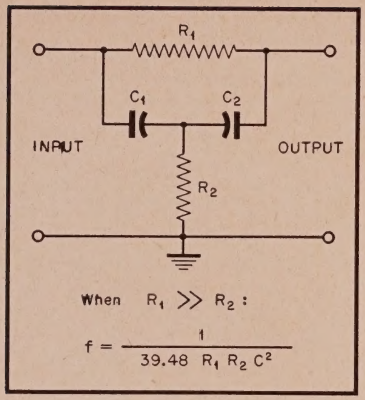

Fig. 8. Bridget-T network. (Null circuit and band supression circuit)

the relationships between the null frequency and the resistance and capacitance values. In this equation; f is in cycles per second, R in ohms, and C in farads.

The balance equation may be simplified considerably by making R_3 and R_4 equal and C_1 and C_2 equal. If R_2 further is made twice R_1, the null frequency may be expressed by means of the second equation in Figure 6. A variable-frequency circuit is obtained by ganging R_3 and R_4 or C_1 and C_2 so that either pair of components may be adjusted simultaneously and always will have the same values at each setting. In practical Wien bridge circuits employed at audio frequencies, it usually is more convenient to adjust the resistors, since high-resistance ganged rheostats are more readily obtained than high-capacitance ganged variable capacitors.

Figure 7 shows the circuit of a parallel-T network. This arrangement also is called a twin-T network. The parallel-T network has a balance frequency equation similar to that of the simplified Wien bridge. In the equation in Figure 7, frequency is expressed in cycles per second, capacitance in farads, and resistance in ohms. The parallel-T circuit has the advantage over the Wien bridge that the former's ground point is identical with the ground of the signal voltage source and output device (detector or load). This permits the obvious advantages of a common ground. This circuit has the comparative inconvenience, however, that *three* resistors (R_1, R_2, and R_3) or three capacitors (C_1, C_2, and C_3) must be adjusted simultaneously and in step, in order to vary the null frequency of the circuit. It is extremely difficult to obtain a 3-gang commercial grade variable resistor with tracking close enough for this purpose. Three-gang variable capacitors offer a mechanical difficulty in that only two rotors (those of C_2 and C_3) may be connected together electrically, the third (C_1) must be isolated electrically while being ganged mechanically to the first two. In addition, the variable capacitors would have to be impractically large in physical size to give capacitance values high enough for low-frequency coverage with desirable resistance values. For these reasons, the parallel-T network is encountered most frequently in electronic circuits as a single-frequency or fixed-tune arrangement.

Figure 8 shows still another R-C null circuit, the bridged-T network. This arrangement takes its name from the fact that the T formed by C_1, C_2, and R_2 is "bridged" by resistor R_1.

The null frequency equation for this circuit is given in Figure 8. This equation is seen to differ somewhat from those applying to the Wien bridge and parallel-T network.

Of the three null circuits described in the foregoing paragraphs, neither can be said to be the "best circuit." Individual demands will determine which of the circuits is most satisfactory for a given application. One of the chief factors to be considered is the fact that both the parallel-T and bridged-T networks allow a common ground between the signal source, null network, and load, while the Wien bridge does not. In applications where a common ground is to be avoided, however, the Wien bridge would be the most satisfactory.

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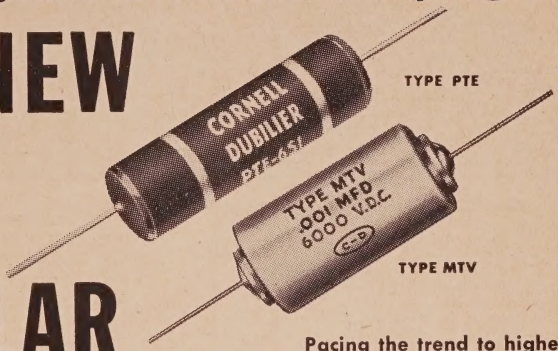

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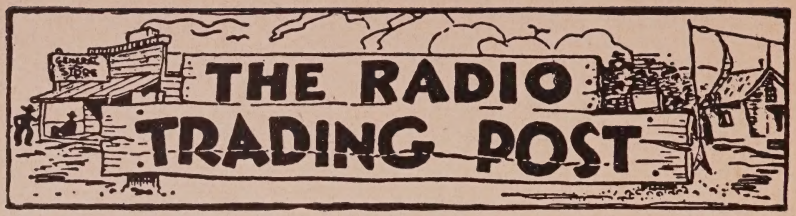

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SWAP—National NC-33 excellent. Want scope made by Hickok or Jackson, no junk. Dependable Radio Service, 3509 Rossville Blvd., Chattanooga, Tenn.

FOR SALE—Hallicrafter S-19 receiver, good cond. First $20. Windol A. Bowen, 1231 Hillridge Dr., Macon, Ga.

TRADE—.32 cal. Iver-Johnson hammerless revolver for Argoflex in good condition, with case; .22 cal. target pistol or Rider's Manuals 1 - 5 complete. John D. Grow, 7712 Westmoreland Ave., Swissvale, Pa.

FOR SALE—Supreme model 542 VOM in bakelite case, $12; Triumph model 351 VOM in metal case, $11. Both excellent and guaranteed. Prefer local. M. Vogel, 531 Thatford Ave., Brooklyn 12. N. Y.

SELL OR SWAP—16mm projector, tubes, test equip., RCA fireglow signs, parts, etc. for tape and disc recorder. John Donelon, 140-21 - 160 St., Jamaica 5, N. Y.

FOR SALE—Hi-fi Browning RJ12 tuner. Identical performance to RJ12A. Recently re-aligned and checked by Browning. Guaranteed like new RJ12A. Shipped in orig. carton, orig. accessories, instructions. $95 f.o.b. or best offer. Fred Barsam, 40 Kimball Road, Watertown, Mass.

FOR SALE—Unused Electro-Voice model 1000 speech clipper, with tubes and instructions, $10. Fred Alexander, 40-06 Vernon Blvd., Long Island City 1, N. Y.

WANTED—Several Rider's Manuals, please state volumes available, price and cond. J. B. Mosley, Box 1, Austell, Georgia.

FOR SALE—Portable "Portomatic" radio-phonograph. a.c.-d.c. radio, short wave, record changer, 10" and 12". Best offer plus delivery. N. Y. C. delivery free. C. Grande, 16 Moylan Pl., N. Y. C.

FOR SALE—Model 78 Chicago Webster wire recorder, perfect cond. for an 8" tilting arbor bench saw. Or what am I offered? C. Schroder, 72-15 - 65 Pl., Glendale, L. I.

FOR SALE OR SWAP—Electronic Designs VTVM, $25; Type L Presto portable record player, 2 speed, up to 16" records, list $290, best offer or what have you? Emanuel Misuraca, 2125 West 6 St., Brooklyn 23, N. Y.

FOR SALE—Wagner motor, 1/4 HP repulsion start — induction run, type RA, frame 65W, 1725 RPM, 1 ph., 60 cy. 110V 4.2A - 220V 2.1A, code H, SK-protector 2E37, 5/8" shaft. Practically new, $15. Carl C. Seidler, 1276 - 47 St. Brooklyn 19, N. Y.

FOR SALE—Jensen K310 co-axial high fidelity 15" speaker, $25. Used less than one hour. Want records by Joseph Schmidt — will pay cash. Harry Brown, 3343 Sedgwick Ave., New York, N. Y.

FOR SALE—Rek-o-kut Challenger disc recorder, Webster wire recorder, Cardax microphone and other accessories. Ed Cherney, 40 Ocean Parkway, Brooklyn 18, N. Y.

WANTED—Small dimension transformer 25 cycle 115 volt in, 60 cycle 80 volt out or 25 cycle 115 volt in, 60 cycle 115 volt out. 100 MA minimum rating. E. Untermyer, P.O. Box 949, Stamford, Conn.

WANTED—Circuit diagram and/or instruction manual for AN/CRW-2 receiver. Al Patlach, 2910 Wallace Ave., Bronx 67, N. Y.

FOR SALE OR SWAP—Supreme radio tester models 592 593 594, panel mounted, less tube chart. Want 10" or -12½" TV set or $75. Langston Radio Shop, J. C. Langston, P.O. Box 179, Trion, Ga.

FOR SALE—DeForest's Home Study Radio Course. Seventy lessons plus laboratory and reel lessons and instructions for use. Also Ghirardi's Radio Physics Course. No reasonable offer refused. Chas. Pandelaky, 108 Bay Terrace, Staten Island 6, N. Y.

FOR SALE—H. H. Scott Dynaural Converter, type 111-A, in new cond., with all tubes, cables, and inst., $25 ppd. Maxwell Strange, 673 Colrain Rd., Greenfield, Mass.

WANTED—NC-33, or equivalent. Will swap one each BC-457 converted to eighty, BC-459, BC-454, and BC-455. Marc Molyneux, Jr., 53 Gulf St., Chickasaw, Ala.

FOR SALE OR SWAP—BC-221 freq. meter in good condition with calibration charts, $75, or what have you? Duane E. Beecher, 132 Doxey St., Ogden, Utah.

FOR SALE—Hammarlund Super Pro R.F. unit complete with Super Pro front panel; Hallicrafters S-36A R.F. unit. Best reasonable offer. Frank A. Lento, 4 Croyden St., New Hyde Park, N. Y.

TRADE—Federal model 288 enlarger, complete with carrying case, easel, and assortment of paper. Need 5" or larger scope in good condition. Will consider TV signal generator in good condition. Slaser's Service Shop, 120 Avondale Ave., Columbus 8, Ohio.

WANTED—Old radios and phonographs before 1928. Excellent cond. and low price. Edison radios, opera cylinder phonos, concert phonos, catalogs and literature. State price and cond. William Miller, 1017 Westgate Rd., Troy, Ohio.

FOR SALE—NRI transmitter — 2(6J5), 6V6, 2C34, fully metered with 3(5Y3) power supply, complete with crystal and schematic. Also wave meter, VTVM and audio gen. all with schematics. $50 or what have you? No shipping. Chas. Monaghan, 26 West 9th Rd., Broad Channel, L. I., N. Y.

FOR SALE—National 1-10 receiver, 1 to 10 meters with 2 meter coils only, no power supply, $15; RCA volt ohmyst junior, excellent condition, $20; Emerson 17" TV chassis, no tubes no yokes, needs minor repairs, contains all RCA major parts, $20. J. R. Halchak, 10 True St., Everett, Mass.

WANTED—For my collection, dial escutcheons — no dial mechanisms or station calibration plates — escutcheon only, and brand name plates taken from old radio cabinets. Give description and price. Frasca Service Shop, South Wilmington, Illinois.

FOR SALE OR SWAP—Radio and electrical books and back issue magazines. Want good fountain pen, stamps, etc. Burbage H. Buchanan, Hawk, N. C.

SWAP—Nilson & Hornung Radio Operating questions and Answers (9th Ed.) for 1949 and 1950 Supreme Radio Diagrams. J. M. Martin, 915 N. E. 7th Pl., Gainesville, Fla.

SELL OR TRADE—Shallcross Hi-low Kelvin and Wheatstone Resistance Bridge, in solid oak carrying case, top cond. Will trade for good 5" scope in good cond. Also have model 050 Philco tube tester with tube chart. A. S. Floyd, 224 N. 4th Ave., Tucson, Arizona.

SELL OR TRADE—1950 National Schools correspondence course; Electro - voice velocity mike; Sam's folders; two superhets. Need Pilotuner; TV-FM booster; tuned signal tracer and tripod movie screen. Frederick Schamu, Liverpool, New York.

FOR SALE—National model NC-57 rec. in excellent cond., 8 months old. Best offer over $70. Martin Rubenberg, 1262 - 45 St., Brooklyn 19, N. Y.

FOR SALE—R.C.P. model 802 tube and set tester; Clough-Brengle model 110 sig. gen.; A.T.R. model 120 C power supply for testing auto radios. $70 takes the lot. Charles V. Commo, 5826 N. Fairhill St., Philadelphia 20, Pa.

FOR SALE—Sam's Photo Facts 1-60 inc. in six binders, excellent, make offer. Recently bought fixed and mobile police gear three truck loads. Send for list and big ham bargains. Priced only for hams, no resale. Nelson K. Stover, 1357 Hill St., York, Pa.

TRADE—5 each of the following tubes: 813, 811, 866, 5U4G. Entire lot for test equip., com. rcvr., tape recorder, camera, or what have you? Nick De Pino, 4076 Lyceum Ave., Venice, Calif.

FOR SALE OR TRADE—Machine for stamping names on pens and pencils in gold leaf, partial roll of gold leaf included. Want $15 or Heathkit VTVM or sig. gen. Also 6 ft. open relay rack, locals only pick up for $3. M. E. Hall, 8003 Camden Ave., Cleveland 2, Ohio.

WANTED—Crei News: Jan., Mar., 1946; Aug., Oct., 1947; Jan., Feb., 1948. Naval Reservist: Mar., Apr., 1949. Instruction Book: Howard Rec. model 430 series 3. Name price. Have HRO and IM series instruction books. James Nichols, 1907 8th St., Marysville, Washington.

WANTED—Advanced radio engineering correspondence course. Payment by bank draft. All geniune letters answered. Full details to: C. E. Birchmeier, Box 5047, G.P.O., Sydney, N.S.W. Australia.

FOR SALE—Partially converted SCR 522 with tubes, $15; unconverted 16mm GSAP camera with used f3.5 lens and filter, $15. Cecil R. Nelin, 1203 N. Walnut, Brady, Texas.

FOR SALE OR TRADE—Shure No. 815 tape recording head; RCA recording head; two Briggs Stratton ½ hp, 1½ hp. Interested in scope or sig. gen. Clyde F. Watts, 218 Lincoln, Wayne, Neb.

WANTED—Recording machine, prefer overhead type. Also playback gear, pickups, turntable, amplifier, and any 16" transcriptions of orchestras. Hy White, 1105 Waller Ave., Winnipeg Canada.

FOR SALE—Model 0-3 Heathkit scope, $32.50; Model 600 Coastwise Electronics sig. gen., 165 kcs. to 56 mcs., $23. Both for $48. Wm. Edgerton, 731 Wright Ave. Stockton, Calif.

FOR SALE—Magnavox 15" 30 watt speaker, 8 ohm, 2" voice coil, 7 lb. Alnico Magnet, $18. Arthur Koehler, 130 Wadsworth Avenue, New York 33, N. Y.

FOR SALE—National HRO-50T communications receiver. A-1 cond., 5 mos. old, with crystal calibrator and 6 sets coils, 480 to 30,000 kc. Cost $421. Will sell to party who can call for it. State offer. John J. Oskay, 70 Senior St. New Brunswick, N. J.

SELL OR SWAP—50 KVA General Radio Variac 110V; two 11 volt 65 amp transformers. Need freq. measuring equipment and communication rec. George Miller, 362 High St., Perth Amboy, N. J.

FOR SALE—6 tube G.E. portable radio No. 260, A-1 cond., $35 f.o.b. Also a Jensen co-axial PM speaker, dual 15" and 5", A-1 cond., $9.50 f.o.b. M. A. Porter, 1709 N. Larrabee St., Chicago 14, Ill.

FOR SALE—Heath Kit TV alignment gen. completely assembled and in good working cond. All instructions included, $35. Morton Radio Service, 7008 Rogers Ave., Merchantville, N. J.

FOR SALE—Heathkit battery eliminator, $20.00; Vol's 1 and 2 of Howard Sams $5 ea.; 134 Polymeter all probes (less hi-voltage), $40; CB-1-60 C-D condenser checker, $17.50. All items excellent and f.o.b. John Gort, Butte, Montana.

FOR SALE—BC348 receiver, with speaker type T6MS, good cond. Check or money order, shipped express collect, $60. Robert A. Werner, Jr., Chestnut St., Laureldale, Pa.

WANTED—Used Instructograph, Candler Junior Code Course or other practical method for code study towards ham license. Very reasonable, please. Joanne Susol, Pier 7, North River, New York 6, N. Y.

FOR SALE—Sonar VFX-680, $32.50; Millen HF 90810 xmtr, $65 without power supply, $80 with, no modulator; Gonset 6 meter converter, $35. All equipment in new condition. Make offer if these prices don't fit you. Joe Roberts, 340 Davis St., Conway, Arkansas.

WANTED—Back issues of Electronics in good condition from 1940 to 1950 for personal library. State issues available and price. L. C. Labarthe, 5532 South Kenwood Avenue, Chicago 37, Illinois.

FOR SALE—Good used Gardner code machine with set of 10 tapes, $15. Will pay postage. M. E. West, Route 2, Lenoir, N. C.

WANTED—(Shut-in) If you have any radio equipment, books or magazines, on radio, music, sheet music, or anything, I will pay express if you want to give them away. Write. Joseph Westmann, Vichy, Mo.

SELL OR TRADE—Webster-Chicago portable wire recorder, model 180, $95. Or will trade for TV rec. or photo. equip. of equal value. Edwin L. Sheldon, Box 142, Rosholt, S. D.

FOR SALE—Pioneer dynamotor 6 volt d.c. input, 310 volt, 175 ma output, $20. Jack A. Estes, Box 492, Memphis Tenn.

FOR SALE—E-200C Precision sig. gen., new with inst. book, $60. Evancich TV Service, 9528 Commercial Ave., Chicago 17, Ill.

SELL OR SWAP—Two spring wind instructographs, McElroy tape puller, 33-1/3 and 78 rpm playbacks, ARC 5 and BC 455 converted to a.c. with power supplies. Want VFO, Morse sounders, resonator, camera, guns, etc. H. E. Leigh, Sr., 197 N. 14th St., San Jose 12, Calif.

WANTED—Miles battery power recorder. Also miniature transmitter and rec. Buy or swap. Ray Sparks, 1664-6 Tarleton St., Los Angeles 21, Calif.

SWAP—A.T.R. d.c.-a.c. inverter, input 110V output 110V 500W; Shure Bros. model "55" mike with 25' mike cord; Atlas floor stand, 12" base. All excellent. Want good outboard motor. Aaron Traiger, 235 East 173 St., New York, N. Y.

POSITION WANTED—N. Y. C. or vicinity. 3 years exp. construction, test, etc., of signal and control, electro magnetic and electronic equipment, for automatic elevators. Knowledge electricity and radio, schooling, adaptable. Isidore Ruslander, 1510 Nelson Ave., Bronx 52, N. Y.

FOR SALE—Army surplus code oscillator, can be used as monitor or audio gen. Freq. range 400 to 1000 cps, in A-1 cond., with speaker and switch, $20. Send money order. Albert E. Truslow, 145 Richard St., New Britain, Conn.

WANTED—TS-323 and other war-surplus radio units; ARC-1, ARC-3, TS-34, ART-13, G-R, Ferris, etc.; high cash prices or trade for 10" TV with Imputuner front end (Police, FM, etc.). Charles C. Littell, Jr., Farhills Box 26, Dayton 9, Ohio.

SELL OR TRADE—Presto 6N recorder in portable 1-B case with 1-C cutting head, excellent cond., $375. Or will trade for a 16mm sound projector in excellent cond. Stanley Forman, 18 Beechcroft St., Brighton, Mass.

WANTED—Two pair handy-talkies, walkie-talkies, or Hallicrafter S-33. State price and condition. L. H. Arpee, Ave. Hidalgo 768 Poniente, Monterrey, N. L., Mexico.

FOR SALE—One 802, one 803, one 829B, two 866A, two 807. Or will trade for electric motors or gasoline engines. Merton Iwerks, P.O. Box 44, Forest City, N. C.

SELL OR TRADE—Very compact 10 meter mobile rig, $40. Write for details. L. C. Freeman, 32 West Oakland Ave., Oaklyn 6. N. J.

SELL OR TRADE—Solar enlarger, excellent, with new 4.5 coated lens, orig. $90, complete with new easel, tongs, trays, funnels, projection print scale, thermometer. Make offer. Or trade for good scope. L. Georges, 1882 W. 9 St., Brooklyn 23, N. Y.

FOR SALE—Parts for all model United States Television — direct view and projection sets. Superior TV Service Co., 772 Sutter Ave., Brooklyn 7, N. Y.

SELL OR SWAP—BC654, also known as SCR284A. Also vibrator unit PE104 which drives same. Interested in test equip. or TV parts. C. F. Albertoni, 2629 Paxton St., Akron 12, Ohio.

FOR SALE—Radio books and manuals. Send for list. Daniel Seidler, 4825 So. Wolcott St., Chicago 9, Ill.

WANTED—Sylvania OA4G tubes. No other brands. Charles Roth, Jr., 1844 Juliet, St. Paul 5, Minn.

WANTED—10 meter mobile gear. State condition and price. Walter F. Burke, 38 Main St., Hopkinton, Mass.

FOR SALE—Late model portable Triplett tube tester;; assembled Heathkit VTVM; tubes. Send postal card for details. Joe Mazik, Wading River, Long Island, N. Y.

WANTED—Motorola FMATR-30-D transmitter-receivers complete with all cords, plugs, handsets, etc. State cond. and price for cash. Sell German and Italian tubes, both army and civilian types. Send for list. Radioshop, 130 Broadway, Hornell, N. Y.

FOR SALE—Hickok 209 vacuum tube multimeter; McMurdo Silver 906 sig. gen.; Sam's Photofacts 1 thru 80 in leather binders, 81 thru 98 in envelopes. Stanley A. Hatlestad, Bancroft, Iowa.

FOR SALE—Hickok 288X sig. gen., $95; Hickok 195A Scope 5", $95; Sprague Telomike T. O. 3, $55; Meissner Analyst, $70. All top cond. with leads and instructions. Check or c.o.d. Chimes Radio and TV, 3749 Madrone Ave., Oakland 19, Calif.

POSITION WANTED—High school grad. wants job in a radio service shop or allied field. Within 60 miles. Excellent in science subjects and has operated home radio shop. Richard Sandretto, 590 Furlong Rd., Sebastopol, Calif.

WANTED—16" to 20" TV chassis in any cond. State make, model, and cond. Ben's Radio & TV, North Tonawanda 2, N. Y.

FOR SALE—3 Shure No. 556 microphones, 3 stands, 1 small boom, three 50' and three 25' cables and fittings, all in portable case. Joseph Wolf, 1400 Front St. N.W., Grand Rapids, Mich.

FOR SALE—Excellent Machlett 6C21. Make reasonable offer. R. Winters, 1208 Vine, Fulton, Mo.

SWAP—Radio parts, meters, books, etc., for good tools, such as, level, wheelbarrow, trowel, saw table, hand saws, etc. Local deal only. Milton Wendroff, 1745 East 16th St., Brooklyn 29, N. Y.

FOR SALE—Two Meissner FM tuners, excellent condition. Best offer. Don F. Deisch Co., 110 South Main, Three Rivers, Mich.

FOR SALE—Due to sickness forced to sell complete Radio Shop. Testing equip., parts, 300 tubes, Sam's Photofacts, and many other items to numerous to mention. $600 or best offer. M. J. Difini, Apt. 56, 358 Esplanade, Hackensack, N. J.

FOR SALE—General Industries 78 r.p.m. record changer in mahogany finish cabinet, late model, excellent cond., $10. Tuck Radio & TV Serv., Point of Rocks, Maryland.

FOR SALE—Webster model 78 wire recorder, excellent. With mike, operating instructions, and 5 one hour spools of wire, $60. Lucien P. Bowe, 71 Daily St., Nutley 10, N. J.

FOR SALE—Up-to-date test equip., parts, tubes. Everything must go. Six test instruments. L. B. Sherrell, Radio-Electric-Shop, Belleville, Ark.

FOR SALE—Hickok 610 TV alignment gen., $125; Hickok 305 scope, $50. All first class cond. F. A. Sherman, 200 Bloomsbury, Havre de Grace, Md.

FOR SALE—RCA Chanalyst, Volt Ohmyst, Precision tube tester, Silver sig. tracer, tubes, parts, Sam's, Riders, etc. Send for details. N. Duncan, Box 739, Springfield, Vermont.

FOR SALE—BC-454-B, $10; BC-459-A, $12; two 3AP1, four 304 TL's, $5. C. F. Gramm, 2152 East Ave., Rochester, N. Y.

WANTED—Harvey-Wells Bandmaster xmtr, any model you have, with or without tubes or modulator. Also want Gonset Tri-band receiver converter. Will buy or swap. Saul Smolar, 1220 Grand Concourse, Bronx 56, N. Y.

FOR SALE—Three 50T, five 866, two RK12, one RK20, two 802, one coto transmitting inductance 160T. Make an offer for all or part. A Stratmoen, Box 536, Lock Haven, Pa.

FOR SALE—Techno-Craft model 16" with X-29 cutting head, excellent; Meissner 9-1065 in excellent cond. with sapphire cutting styli and playback; tubes. Send for list. Sheldon Radio, Osage, Iowa.

FOR SALE—Hallicrafters S-38B rec., A-1 cond., $45; CR-6B/U 3920 kc. crystal, $2. Carl R. Kolker, Boyne City, Mich.

FOR SALE—Sig. gen., resistor-condenser tester, and tube tester. All in A-1 cond. $20 ea., or $50 for all three. Or will trade for good portable belt sander. Wood's Radio Serv., Box 75, Jeffersonville, N. Y.

BUY, SELL, OR TRADE—Radio and TV tubes. Send your lists for trade and those wanted. John Andrew's, 740 Maple St., Bethlehem, Pa.

FOR SALE OR TRADE—666H Triplett VOM, excellent shape, $15. Want Precision E-200C sig. gen. James D. Kennedy, Box 603, Dover, N. J.

FOR SALE—Supreme 4252 tube tester in good cond., $15; BC611 handie-talkie, with tubes, crystals, and instruction book, $50; 110V d.c. to 350V d.c. gen., $10. Want Millen grid dipper. H. McEntee, 490 Fairfield, Ridgewood, N. J.

SELL OR TRADE—Two portable wire recorders; one Webster and one St. George with home built amplifiers for test equipment or cash. Frank Schwarz, 40-35 Ithaca St., Elmhurst, L. I., N. Y.

SWAP—Model New York Central Lionel electric train, tracks and accessories for a tube tester in good condition. Train and accessories cost $100. R. W. Landry, 2600 Pauger St., New Orleans, La.

WANTED—Hi-quality FM tuner, VTVM, will pay cash or swap machinist's tools. Morgan Kennedy, 16 Monroe St., New York 2, N. Y.

TRADE—New Astatic AT-1 TV booster; 1947 version National Schools radio and TV Course. Want watchmaker's tools in good condition, also, new repair parts assortments. Anthony Guide, 17 Wolcott St., Malden 48, Mass.

FOR SALE OR TRADE—Radio test equip. and radio parts. Want Leica camera or movie equip. Mathew J. Duniphin, Box 1091, Wewoka, Okla.

FOR SALE—Jackson model 641 sig. gen., excellent cond., $100. Jim Sylvester, 3370 "C," Niagara Falls, N. Y.

WANTED—S-38 or S-38B receiver in good condition or equivalent. Also condenser checker. Will consider assembled kit. George Crist, Litchfield, Mich.

FOR SALE—Collins 32V-1 transmitter and 75A-1 rec. Both in excellent cond. Also Micamold XTR-1 transmitter with 80 meter crystal and tubes. Make cash offer for all or part. Seid G. Moy, 259 W. 21st St., N. Y. C.

SELL OR TRADE—National Schools Radio and TV Course minus receiver parts. What have you?" I. Zilg, 1303 West 2 St., San Pedro, Calif.

FOR SALE—BC683 tank set for a.c. operation. Tunes from 29 to 41 megs, $60. Commercial Radio Corp., 36 Brattle St., Boston 8, Mass.

FOR SALE—Rider Manuals 1, 2, 3, 4, 5, 6, 16, 17, 18, excellent cond. J. S. Chance, 712 Santa Fe St., Alva, Okla.

FOR SALE—Lysco VFO, very compact, 40 and 80 mtr. output, plugs into xtal socket, illuminated dial, clean, $10. Herbert Greenberg, 775 E. 52nd St., Brooklyn 3, N. Y.

SALE OR TRADE—NC100XA very fine communications receiver, $65, or ham gear. Dave Siegel, 43 Webster Ave., Brooklyn 30, N. Y.

FOR SALE—Jensen model JHP52 type 601 15" coaxial speaker, $35. Irwin Karabush. 4913½ W Quincy St., Chicago 44, Illinois.

WANTED—Surplus ohm meter or volt ohm meter. Will trade tubes, condensers, or other radio parts, or will pay cash. David Sutherland, Penhook, Va.

WANTED—A local licensed ham to use temporarily a Harvey-Wells TBS-50D with D-104 mike and powr. supply, in exchange for tutoring in code and theory — until a ticket is secured. Joseph Zukauskas, 2227 Germantown Ave., Philadelphia 33, Pa.

SELL OR TRADE—Stewart-Warner R 183-A 8 tube 3 band rec. Console, in A-1 cond. Marty Weltz, c/o Terrace Diner, E. 12th and Oneida Sts., Oswego, N. Y.

TRADE—Coyne Reference Set in good condition, covering all fields of electronics. Want pocket size VOM meter. State model No., cond., and specifications. Merrill Shupe, Rt. 1 Gooding, Idaho.

SELL OR TRADE—Mercury II 35mm camera; B&J 4 x 5 press camera; Revere model 88 movie camera; and a 500 watt projector. Need Dumont scope. K. H. Stello, B.O.Q. 140, Treasure Island, Calif.

WANTED—Rider Manuals, Nos. 15 and up, singly or in a group. State cond. and price. Elton Hoornstra, 305 Ann St., Sault Sainte Marie, Mich.

FOR SALE—Amperite PGH hi-imp. dynamic mike and desk stand, $12.50 f.o.b.; RCA Rider Chanalyst No. 162C, $65 f.o.b.; Webster wire recorder, 10 hrs. wire, $70 f.o.b. V. Hein, 418 Gregory, Rockford, Ill.

WANTED—Complete 10, 20, 40, 80 meter fone and cw rig. Running about 250 watts. What have you? H. Leis, 2007 Vance Ave., Alexandria, La.

WANTED—Bound vols. of RCA 1939, 1940, and 1947-48 service notes. Good cond. only. Robert Barton, 973 Winchester Ave., Hamden, Conn.

FOR SALE—National short wave receiver with "S" meter and crystal phasing. 8 watt output. $95 if called for. H. Latko, 1922 Dickens, Chicago, Ill.

WANTED—7" TV receivers. Preferably less tube and cabinet in non-operative but repairable condition. Litson, 724 N. Louisville, Tulsa, Oklahoma.

WANTED—Magnifier for 10" TV, o-1 meters ohmmeters; car radio eliminator, and other test equip. F. Cabon, 1504 La-Baig, Hollywood 28, Calif.

WANTED—Meissner 8C FM tuner or Brooks FM tuner. Must be in A-1 cond. State price. S. Bryan, 2104 Dayton St., Silver Spring, Maryland.

WANTED—Remote control head for '38 Chevrolet radio or one that can be adapted as a universal control. Manuel J. Smith 1205, Lamanche St., New Orleans 17, La.

WANTED—Radio City Products sig. gen. Model 710 for AM alignment. Will pay cash or trade. A. Lipiner, 1032 Rutland Rd., Brooklyn 12, N. Y.

SALE OR TRADE—Sonar FM exciter No. XE-10, used very little, perfect cond. Best offer. Dolan Delaney, Petersburg, Indiana.

WANTED—Marine radio and equipment. Have ham radio gear and ½ h.p. also 1 h.p. G.E. d.c. motor. L. Meister, 5 Highfield Lane, Nutley, N. J.

FOR SALE—20 coin-operated console radios, $10 ea.; 15 RCA coin radios with tables, $25 ea. All in good working cond., f.o.b. Delair. M. E. Stebbins, Delair, N. J.

SELL OR TRADE—Two 12" PM speakers, radios and amplifier chassis, and parts. Send for list. Trade for power tools, motors, or cash. Or? Vernon Petry, 4545 Ellman, Blue Ash, Ohio.

SELL OR TRADE—Double stacked vee beam TV aerial, used 1 mo. Want tubes, test equip., etc. Gerald R. Kernan, Harpers Ferry, Iowa.

FOR SALE—Brush BK403 2-speed portable tape recorder, Hi and Lo input mike impedances, 600 ohm output, original carton. T. Braunstein, 190 South 8th St., Brooklyn 11, N. Y.

WANTED—110 volt, 60 cycle a.c. generator, gasoline driven, to supply 1500 to 2500 watts or better. State price, cond., and mfgr's. name. L. D. Brown, 83 Mills St., Morristown, N. J.

TRADE—1200 assorted tubes, radios, amplifiers, meters, test equip., manuals, books, motors, parts, half ton assorted radio hardware for antique/modern guns any cond. C. H. Finley, Sentinel, Ariz.

TRADE—Excellent Olympic typewriter for tape recorder or Medalist I camera. Mitchell Metzarek, 2174 Melvina Ave., Chicago 39, Ill.

WANTED—Publications relating to radio, TV, electronics — courses and magazines. Send list and prices. Selcraft, 394 Spring Valley, N. Y.

FOR SALE—Heathkit electronic switch, model S-2, in perfect cond. Will send express collect for $17.50. David Dillon, 1253 Fennimore St., Fairmont, W. Va.

FOR SALE—Series 910 Precision tube tester, excellent condition, $25. J. D. Blankenship, Grayson, Ky.

WANTED—S-40 or NC-57. Will pay cash or trade tubes. G. H. Swiska, 109 E. School St., Woonsocket, R. I.

SWAP—Table model 78 rpm radio-phonograph. Want enlarger or magnifier for 7" RCA TV, camera, or what have you? L. V. Connolly, Jr., 72 Condict St., Jersey City, N. J.

FOR SALE—Model 610 ATR battery eliminator and charger, very good, $30 postpaid. W. Siuta, 4011 Lawndale, Detroit 10, Mich.

FOR SALE—Equip., some parts, and tubes. L. L. Waite, USNTC, Supply Dept., Bainbridge, Md.

WANTED—1947 Nash Radio. Will pay cash or trade tubes or other radio parts. Vincent Amatrudi, 1133 Morrison Ave., Bronx 59, N. Y.

FOR SALE—CREI radio engineering course. 15 vols. in all. First cashiers check for 130 takes them all. Not sold separately. Wm. Edgerton, 731 Wright Ave., Stockton, Calif.

FOR SALE OR TRADE—Sam's 1 to 10; Precision sig. gen.; tubetester; tubes; Mallory 6V bench supply. All items excellent. Write for list. Bernard Loebe, 291 Poplar St., Grenada, Miss.

WANTED—Radio test equip. for modern sets that may be bought cheap. Will swap Echophone EC-1A in good cond. for BC455 and power supply. T. K. Unnold, Box 111, Fryeburg, Me.

FOR SALE—Dynamotor pe73c with cables, also parts for BC375E. All in good cond. Best offer takes them. Donald Granger, P.O. Box 6, Warsaw, N. Y.

TRADE—Complete Deforest Radio and TV Course for a good tape recorder. George Edelman, 985 Simpson St., Bronx 59, N. Y.

FOR SALE—NRI tester, excellent cond., shipped prepaid, $10. Want Precision tube tester model 10-12P in good cond. State price. Charles R. Graff, 6640 Edmund St., Philadelphia 35, Pa.

FOR SALE—Rider Manuals, 4 to 13, 10 books for $75. Precision sig. gen., series E200, A-1 shape, $40. Part cash, balance c.o.d. plus postage. R. Sherman, 1205 W. 21st St., Sioux Falls, So. Dak.

WANTED—Good used tape recorder. Send price and full info. Alex Cohen, 63-60 102 St., Forest Hills, N. Y. C.

FOR SALE—Hallicrafters HT-9, 100 watt transmitter with coils and crystal for 10 meters, excellent cond., $150. Prefer local buyer. Charles Madek, 6 Dawes Terrace, Dorchester 25, Mass.

FOR SALE—Excellent RCA wire recorder, model MI-12775 complete with plug-in cartridge. Retails for $149.50, will sell for $55 cash. Rustan Bros., Red Lake Falls, Minn.

WANTED—Late model Chevrolet auto radio. Have a 3¼ x 4¼ Speed Graphic and many other articles and/or cash. M. Gianfrocco, 80 Appleton St., Providence 9, R. I.

FOR SALE—G.E. violet ray and sun lamp, floor stand model, regulated anyway, $10. Thomas Byrne, 24 Linden Ave., Bronx 61, N. Y.

SELL OR TRADE—Complete 50 watt portable PA system, a.c. or 6V d.c.,, 2 driver trumpets, 2 auditorium speakers, phono, crystal mike, extra vibrators, all perfect. $200 cash or trade for Crosley station wagon. Phil Wood, Bangor, Michigan.

WANTED—46 to 48 genuine Ford radio. Have SCR610, BC1023, 0-4 amp RF meter, two 0-500 micro amp meters, meter for I-166. All excellent. Robert Jessup, 797 State St., Chester, Ill.

FOR SALE OR TRADE—Riders vols. 1-7, radio tubes, speakers, and other parts. Toney's Radio, Winter's Ave., 824 West Hazleton, Pa.

FOR SALE—1C7, 1F7, 1D5, 1H4, and other 2 volt tubes for sale at 40 cents each. H. F. Hagedorn, Stover, Mo.

SELL OR SWAP—New 8 string electric Hawaiian guitar (Magnatone) complete with case, retailing for $119. Swap for electronic test equip., communications rec., or? Ben L. Sandberg, 932 Westbourne Dr., Los Angeles 46, Calif.

TRADE—Model 976 E.L. 6V rectifier; model 250 G.E. portable radio has wet battery and built in charger. All good cond. Want 7 x 50 prism type binocs or photo equip. Leslie E. Boner, 209 Sylvia Ave., Christopher, Ill.

TRADE OR SELL—Eico model 221 VTVOM for signal gen. S. Laura, 8602 Fort Hamilton Pky., Brooklyn 9, N. Y.

FOR SALE—Model 650 Supreme scope, complete instructions, $48; Superior model 660 sig. gen., $50. These instruments were never used. C.O.D. or cash. Anders Radio & TV, 33 Adams St., Nelsonville, Ohio.

FOR SALE OR SWAP—Hallicrafters Sky Buddy in fair cond. Needs paint job and new speaker. Want small communications receiver or Gonset Converter. Bill Breeze, 992 - 12th Ave. So., St. Petersburg, Fla.

FOR SALE—Do you want to start a radio shop? I have one for sale very reasonable. Will furnish upon request all details. Stewart Rivers, 1533 So. 53rd St., W. Philadelphia 43, Pa.

FOR SALE—(N.Y.C. area) Eico model No. 315 sig. gen., $45; NRI VTVM, needs batteries, $5. Louis Porsetsky, 5501 Snyder Ave., Brooklyn 3, N. Y.

WANTED—Hallicrafters 7" models 505 or T-54 TV. Must be in working condition. Earl Cottrell, 228 Main St., Whitesboro, N. Y.

TRADE—Nearly new Zenith portable and a pilot FM tuner. Want signal tracer, scope, tubes, movie projector, or what have you? Den Jex, 571 W Van Buren St., Battle Creek, Mich.

WANTED—Back issues ARRL handbooks. Have many receiving and transmitting parts for trade or sale. Write for list. Interested in 8mm movie equip. also. Carl A. McKay, 1724 Rumsey, Fort Wayne 7, Ind.

WANTED—BC348, ART-13, RTA1-B, ARC 1 & 3, R89B, ARN 7 and other surplus. Also gasoline gen., and gas garden tractor. Have ham gear, German cameras, watches, or cash. B. C. Higley, 82 Main St., Matawan, N. J.

WANTED—Surplus receivers, transmitters, TV tubes, receiving and transmitting tubes. We sell all types of TV picture tubes. Williams Electronics Co., 62 Cortlandt St., New York, N. Y.

TRADE—Saxophone, Busecher, C-melody, (silver). Want scope, TV set, test equip., Rider Manuals. John J. Hitzenhammer, 1319 25th St., Richmond, Calif.

SELL—Garrard changer parts, crystals, etc.; miscellaneous hard to get parts, tubes, etc. Send for list. A. & B. Radio Laboratory, 539 Gough St., San Francisco 2, California.

SELL OR TRADE—Turner 34X mike in good condition with desk stand; 12 pc. Dietzgen Drafting set like new. Want good tube tester, cash or what have you? E. W. Nadolny, 449 Koons Ave., Buffalo 11, N. Y.

WANTED—Collin's 310B-1 or 310A-3 exciter unit. Will pay cash. R. A. Lazzazero, 367 Ludington St., Buffalo 6, N. Y.

WANTED—Admiral chassis only, model 7C60, chassis 6B1 (no speaker or record changer needed), in used cond., Quote price. Charlie's Radio Shop, 404 S. Main St., Las Cruces, New Mexico.

FOR SALE OR TRADE—Complete National Schools Radio and TV Correspondence Course for camera or cash. Bernard Goldstein, 58-02 Myrtle Ave., Brooklyn 27, N. Y.

WANTED—Millen grid-dipper, good cond. Will swap two good used 4-125-A tubes, and one unused 250th tube for same. Marc Molyneux, Jr., 53 Gulf St., Chickasaw, Alabama.

TRADE—St. George wire recording mechanism, excellent, with crystal phono pickup and erase oscillator coil, in carrying case, less amplifier. Want good communications receiver, or what have you? Bill Nohrn, 4224 Brockmont Dr., Albuquerque, New Mexico.

FOR SALE—Hudson auto radio DB-42, rebuilt power pack and new 6" PM speaker, 6 tubes, excellent cond., $20 f.o.b. A. Edward Ruppel, 1207 Adams St., Saginaw 54, Mich.

WANTED—Ship to shore radio telephone and directory finder for 6 or 12 volt d.c. Clark Mesler, 1039 Alger St., S. E., Grand Rapids, Mich.

FOR SALE—Hallicrafters HT-9, with 80, 20, and 10 mtr coils, and 2 spare 814's, $200. Shipped express collect. Also Dejur Versatile Professional (4 x 5) enlarger, $120. Ellis H. Maris, R.D. 1, Coatesville, Pa.

FOR SALE—Brook 12A3 Hi-Fi amplifier, Garrard RC-80 record changer. All excellent, never used, in original boxes. V. R. Parker, Box 88, Fitchburg, Mass.

FOR SALE—Rider Manuals, vols. 7 to 14. All eight in perfect condition. Want test equip., or what have you? Edward A. Turnier. Five Corner Station, Box 52, Jersey City, N. J.

WANTED—Meissner tuning unit, No. 13-7604 or No. 13-7601. Will send cash. Robert L. Patterson, 104 Carlton Ave., Brooklyn 1, N. Y.

SELL OR SWAP—Bliley CCO-2A crystal controlled oscillator and 2 amateur crystals for 80 meter band, $8, or what have you? Michael Servetnick, 1418 5th Ave., Pittsburgh, Pa.

FOR SALE OR SWAP—Precision E-200C in new condition complete with instruction manual and calibrated points for vernier scale. Used only half a dozen times. $55 or swap for what have you? Duane E. Beecher, 132 Doxey St., Ogden, Utah.

WANTED—Scope suitable for TV alignment and good tube tester. Have to offer, amplifiers, mikes, TV sets, musical instruments, and cash. John Arnold, P.O.B. 84, Bluffs, Ill.

FOR SALE—15 watt P.A. system complete with one 8" and two 12" inside speakers in cases, two University IB8 outside speakers, Webster phono pickup and case, Shure crystal mike with desk and floor stands. All cables. A-1 cond. Walter L. Babcock, 405 Sayles St., Oneida, N. Y.

TRADE—Winchester model 97 pump gun with poly choke, carrying case, and cleaning outfit. Valued at $80. For sweep generator and battery eliminator. M. Santangelo, 437 W. 10th Ave., Conshohocken, Pa.

SWAP—Korelle, single reflex camera, 3.5 lens, case included, for Precision E-200C sig. gen. or better type gen. James P. Toore, 57 St. Nicholas Ave., Brooklyn 27, N. Y.

FOR SALE—Circuit diagrams and data for individual model or chassis. TV — 85 cents, others — 75 cents ea. Raymond Conover, Stone Ridge, N. Y.

FOR SALE—Hro-7 communications receiver, complete, speaker, power supply, 4 coils (A, B, C, D), used few hrs., $225; Precision tube, volt, ohm, ammeter, cost $95, asking $70. Louis Ciancio, 5153 Dearborn St., Pittsburgh 24, Pa.

SWAP—For TV set in operating cond., or tuner, FM-AM only, one model 80 Webster wire recorder in excellent cond., 6 spools of wire, one 1 hr, three ½'s, two ¼'s, plus one Turner 22X low mike. J. Alan Felt, 20 Vinton Rd., Madison, N. J.

FOR SALE—4 x 5 speed graphic camera outfit and other items to trade for 9" South Bend accessories, or late model communications rec. Fred J. Gommo, 44-05 Macnish St., Apt. 2F, Elmhurst 73, N. Y.

FOR SALE—Solar Exam-eter model CF, Philco audio sig. gen., portable NRI multimeter and sig. gen. by Triplett, Precision EV-10 vacuum tube volt-ohm meter, Precision 920 tube tester, approved TV field strength meter. Miller Radio Service, Forest, Ohio.

FOR SALE—RCA 630TS chassis, complete, voltage doubler with 16" rect. tube, never used, $100. F. Guise, 450 Court St., Elizabeth, N. J.

FOR SALE—RCA record changer, chassis only, 78 rpm, $5; RCA metal 16" tube, set into a table model TV rec., less chassis, $25. Sam N. Narefsky, 4031 48th St., Long Island City, N. Y.

FOR SALE—Used TV's, standard brands in working cond.; B.C.-412 scope converted, operating but needs work, $30 or best offer. Omar's Radio, 9714 Dodge Lane, Franklin Park, Ill.

TRADE—SCR-625 mine detector, never used; guitar, postage stamps. Want rec. and xmtr. J. Snow, 589 E. 348 Willoughby, Ohio.

FOR SALE—Radio Repair Shop, fully equipped plus stock, excellent location, very low rental, very attractive income. Sensational opportunity. Solomon's Radio, 751 New Lots Ave., Brooklyn 7, N. Y.

SWAP—NRI power supply, airplane design manual, over 1000 Amer. and foreign stamps, many unused; Jewell 64 thermo. type meter, 0-10 amps value $12. Want good used silent 8mm projector, new receiving tubes, or? Arthur Bulmer, 90 S. Main St., Rockland, Me.

FOR SALE—Rider Manuals 1-5 abridged thru 17, $150; Hickok 288X sig. gen., $150; ATR 6 volt 10 amp battery eliminator, $30; FAS hi fi amplifier, chassis construction, less speakers and network, 20 - 20,000 cps, $75. R. T. Whitaker, Bishop, Texas.

SELL OR TRADE—Best offer takes excellent Turner electric pickup for stringed instrument, list $19, make offer. Swap Motorola FM, 78 rpm record changer and electric shaver. Need tubes, photo enlarger. D. Buck, 32 Ardmore Terrace, Collingswood, N. J.

FOR SALE—Closing out, send for list. There is no "junk" in anything I have. Albert C. Hart, 207 N. Raymond St., Griffith, Indiana.

FOR SALE—Kit of rubber stamp symbols for electronic drawing. Kit includes 20 of most frequently used symbols each mounted on ¼" plexiglas, bottle of opaque ink, two facing ink pads, styrene box, $15. John Griffin, 2157 James Ave., St. Paul 5, Minn.

FOR SALE—Hickok model 188X sig. gen., $100; Hickok model 198 audio sig. gen., $30, Sola constant voltage transformer, $25; G.R. type 100-R 2KW Variac, $25. L. R. Battersby, 31 Grant Pl., Red Bank, New Jersey.

WANTED—Exacta, Leica, etc., 35mm camera. Have brand new HT-17 transmitter, 72" enclosed rack, panels, transmitting meters, 13 x 17 blank chassis, high voltage condensers, test equipment. Cash if good buy. Gus Jacobson, 264 E. 165, N. Y. 56, N. Y.

FOR SALE OR TRADE—20W AM xmtr, needs slight work, $25; NC-57 rcvr., $65; 200 ma. swing choke, $2; xfmr pri. 110V a.c. - sec. 1100-0-1100 at 250 ma., $5 Could use 5" scope. S. Egelberg, 1485 Vyse Ave., Bronx 60, N. Y.

FOR SALE—General Industries model GI-R90 disk recorder in case; Markel Record player model 71 on walnut base; Meissner FM receptor model 8C in walnut case; Carbeneau, Plays-all; 33-1/3 and 45 L.P. record adaptor. All excellent, $85. Edward Crevoi, 719 Schofield Bldg, Cleveland 15, Ohio.

FOR SALE—Speakers, pickups, transmitting and receiving tubes, and all kinds of parts. All at low prices as I am moving. Paul H. Prokes, 9216 S. Menard Ave., Oak Lawn, Ill.

TRADE—VHF 152, BC-221AK, Contax I with 2.8 Zeiss Tessar. Want 16mm movie equip. Prefer Bolex or Bell & Howell 70DA camera. George Tate, Woodland Drive, Rt. 7, Greenville, S. C.

TRADE—Plugtester, phono records, books, gun, phono and clock parts, etc. Want VOM, tube tester, cond. tester, soldering iron, service manuals, and other tech. books. James Morse, Rt. 2, Box 85, Hammon, Oklahoma.

FOR SALE—Amplydines and motor generators. What do you need? Tallen Co., Inc., 562 Atlantic Ave., Brooklyn, N. Y.

FOR SALE—Radio shop on U. S. highway 65. Fully equipped, in lively TV area, service station and modern living quarters, well established. Reason for selling, death of owner. Rankin Radio Service, Zearing, Iowa.

SELL—Allied 16" recorder, overhead feed, 120 lines per inch, inside out, in case, $125. Other equip., list on request. Prefer locals. D. Pace, 564 Audubon Ave., N. Y. C. 33, N. Y.

SALE OR TRADE—BC-312N; 438 Detrola; 524 Setchell-Carlson; 6V dyn. Philco; ARR-1; Gonset 3-30; NC-33. J. W. Doud, 223 S. 10th St., Salina, Kans.

FOR SALE OR TRADE—Two 813's and filament transformer, $10; 40 watt modulator complete, $25; 1000 volt, 125 ma., power supply, $35. Want Heathkit or similar sig. gen. and tube tester or oscilloscope. R. Fisher, 125½ Walker St., Shelbyville, Indiana.

FOR SALE OR TRADE—Deluxe transvision 12½" TV with latest Dumont tuner. Also hard to get TV and radio tubes. Need test equip. Val Sanford, 71 West 104 St., New York 25, N. Y.

FOR SALE—Hickok 155 traceometer; Hickok 180 crystal controlled gen.; Hickok 530 tube tester; Rider Manuals 1-11. All items excellent. Frank Beckman, 2442 76th Ave., Oakland 5, Calif.

FOR SALE—Air King wire recorder, with four ½-hour spools and good dynamic mike, good cond., $60. Or swap for Ampro tape recording mechanism. S. N. Tanner, 425 Iberia St. New Iberia, La.

SWAP—.25 cal. German automatic in A-1 cond. Want sig. gen. or tube tester. R. D. Rosenkrans, c/o Iowa Public Serv. Co., P. O. Box 778, Sioux City, Iowa.

SELL OR TRADE—Back copies of QST, Radio, and Radio Craft. Want 20 to 30 watt hi fi amplifier with at least two mike connection, one tuner and one phono. Wm. E. Klann, 5420 Steadman, Dearborn 2, Mich.

SELL OR SWAP—Industrial Model Warner Brush Electro-plater, cost $60. Want good standard make electric hand saw. Also have Supreme Analyzer, a.c.-d.c. volts and ma. and ohms, $25. L. M. Burtis, 2333 S. E. 53rd Ave., Portland 15, Oregon.

FOR SALE—Record player, automatic change and wireless, $10; model 615 Jackson tester, $15; FM Pilotuner, $20; R.M.E-45 rec. Write for details. T. H. Kendall, Gold Hill, N. C.

FOR SALE—Varitran VIM, $7.50; two Sarkes-Tarzian tuners less tubes, $5 ea.; two VO-3-B amplifiers, $25 ea.; two 3E29, $5 ea. John Dipinto, 177-42 Troutville Rd., Springfield Gardens 13, N. Y.

FOR SALE—Radio City Products tube checker, with carrying case, uses wall charts, tests tubes 99%, no miniatures. $15 plus postage, or highest offer. M. Brown, 525 Penna. Ave., Elmira, N. Y.

TRADE—Cash and Underwood noiseless typewriter with new ribbon, cover, brush, and table, for receiver. Want HQ 129, HQ 120, SX 43, SX 25, or other. Larry E. Wise, 811 Holly St., Lima, Ohio.

FOR SALE—Hallicrafters receivers: S-39, S40, S41, SX25. No trade. Make offer for quick disposal. Joseph M. Malak, Center and Sperry Rds., Chesterland, Ohio.

SELL OR SWAP—Detecto baby scale, balance type, hardly used, reads from 0 to 30 lbs. Want ham, B.C. or T.V. parts or equipment. Fred Levitt, 119-53 230th St., Cambria Heights 11, N. Y.

FOR SALE—Monitor Crystaliner in perfect condition. Model SG101, 175-1700 kc. with plug for exterior crystals. Nathan W. Anderson, 1114 Idaho St., Norman, Okla.

FOR SALE—7" TV Transvision chassis in good shape, new set of tubes including picture tube recently installed. Make cash offer. Greiner Radio Service Co., 299 So. Elmwood Ave., Buffalo, N. Y.

WANTED—Signal generator, known make. Must be in excellent cond., cash. J. Raisman, 1751 Georges Lane, Philadelphia 31, Pa.

SELL OR TRADE—Ampro tape recorder with mike and tape in perfect cond. Want good TV set. Norman Lacroix, 21 Mavis St., Pawtucket, R. I.

CASH OR SWAPPING—All clean and preferably boxed receiving, transmitting, and special-purpose tubes. B. N. Gensler, 136 Liberty St., N. Y. 6, N. Y.

WANTED—Control head for Motorola auto radio (409) for 1950 Ford. State price or what is wanted in exchange. Selcraft Box 394, Spring Valley, N. Y.

SELL OR TRADE—Paper filter condenser blocks up to 18 mfd. tested at 1000 volts. Also radio books and experimenter schematic diagrams. Anselme Laperriere, Vercheres, Que., Canada.

FOR SALE—Precision VTVM, EV 10, in hardwood portable case complete with high freq. probe. Cond. guaranteed or your money back, $50. R. A. Dressler, 355 Front St., Millersburg, Pa.

TRADE—Triplett sig. gen. model 3432; Eico scope model 425, wired with crystal probe. Also 20 watt amp. with mike. All excellent. Want wire recorder, 10" or 12" TV set, or what have you? Truman Childers, North Kenova, Ohio.

SELL OR SWAP—PE-103 dynamotor. Need a SCR-522 or VHF equipment. Local prospects desired. Albert F. Valunas, 91 Lynwood Ave., Wilkes-Barre, Pa.

WANTED—FM set or tuner covering 88-108 megacycles. State price, name, and cond. P. Pesce, 5340 Greene St., Philadelphia 44, Pa.

SWAP OR SELL—Philco under dash car radio, good cond., $18; Motorola gasoline car heater, complete with service manual. Want tape or wire recorder, electric spanish guitar, amplifier, mercury switches, etc. B. S. Ciolkosz, 407 S. Kilbourn Ave., Chicago 24, Ill.

FOR SALE—Lafayette AM-FM set. Phono plug-in, output for speaker system, self-contained monitor, $22. R. C. Barley, 144 W. Second Ave., Roselle, N. J.

FOR SALE—Hickok model 156 indicating traceometer used for display purposes only. Excellent cond., $125 f.o.b. R. G. Kempton, 50 Washington Rd., Scotia 2, New York.

WANTED—Light weight aircraft receiver, battery operated. Also transmitter. H. I. Griffiths, 39-82 65 Pl., Woodside 77 L. I., N. Y.

SWAP—General Electronics 200 sig. gen. for a usable tube tester. Gen. is excellent. J. E. Blake, Box 607, Carson City, Nev.

WANTED—NRI Radio TV Communications Course with all service manuals. M. Gleicher, 62 Edwards St., Roslyn Hgts., L. I., N. Y.

FOR SALE—NRI sig. tracer, multimeter, tube tester, sig. gen., $110. All in excellent cond. Valuable material included as bonus. Walter Piotrowski, 225 Myrtle Ave., Johnson City, N. Y.

WANTED—Pictorial and schematic diagrams for the type SSR-5-B short-wave portable. It is a 2-12 mc receiver designed for the O.S.S. F. Atkins, 416 Pacific St., Brooklyn, N. Y.

SELL OR TRADE—Twin-Trax tape recorder mechanical mechanism, experimentor's model, never used, $55 or best offer. Or trade for ham receiver. Also have Airline complete wire recorder, best offer. A. W. Miller, 712-H Ingraham St. N. W., Washington 11, D. C.

FOR SALE—2 meter station complete from mike to antenna, $85 plus shipping. Interested in test equipment. Walter J. Smith 517 Lansing St., Charlotte, Mich.

FOR SALE—Riders Radio Manuals, 13 vols. and 2 index, Nos. 1 to 13 inclusive, $190 or best offer. Leitch Radio, 34 Park Drive, West Orange, N. J.

TRADE—Supreme Service Notes on record players, automatic changers, wireless units, and home recorders; Audels Radioman's Guide; Kawee pack camera, 2¼ x 3¼, f4.5 lens, built-in timer. Want printing press. V. Lombardo, 1679 Lafayette Ave., New York 72, N. Y.

FOR SALE—Miessner signal shifter, $75. James E. Sullivan, 1532 Maple Ave., Terre Haute, Indiana.

WANTED—RCA battery type VTVM and schematic. Cheshire TV Service, Main St., Cheshire, Conn.

SELL OR SWAP—Motorola "60" car radio, Chrysler corp. model 17 car heater, both excellent. Also Remington-Rand standard typewriter needing minor repairs. Want radio equipment. Len Ginsberg, 209 E. 16 St., Brooklyn 26, N. Y.

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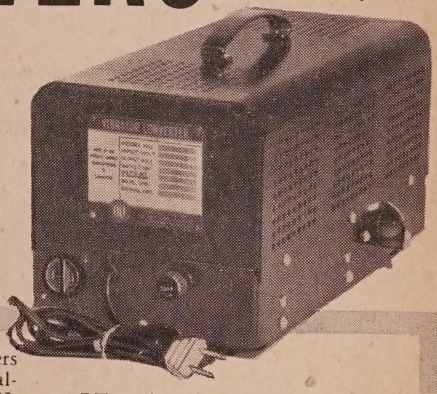

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